New PIE equipment will support GNEP

Idaho National Laboratory (INL) has long been recognized as the place where commercial nuclear energy had its beginnings over 50 years ago. Now, when many foresee a rebirth of nuclear energy, INL is poised to realign itself with top nuclear research and development laboratories around the world, thanks to a $15 million commitment from the Department of Energy (DOE).

Photo: Remote handler

Anticipated upgrades include the integration of a shielded suite of examination instruments into the Analytical Laboratory, allowing researchers to analyze used fuel samples with greater accuracy and efficiency.

The money will go to purchase new post-irradiation examination (PIE) equipment at INL--high-tech instruments that will allow researchers to qualify and understand the behavior of new nuclear test fuels on a micro scale. This represents a significant investment in the technology infrastructure needed to develop advanced Global Nuclear Energy Partnership (GNEP) technologies.

State-of-the-art materials characterization equipment will allow researchers at INL to investigate and analyze experimental GNEP test fuels with a degree of accuracy that was not possible in the past, said INL's Jon Carmack, deputy director of the GNEP Transuranic Fuel Development Program.

"The advanced materials research community has developed many new characterization and analysis techniques over the past few years that have aided the computer industry to make revolutionary advances in microchip manufacturing and performance through a fundamental understanding of material behavior," Carmack said.

Tools used to study materials behavior and improve performance in industries such as microchip manufacturing have never been applied to nuclear fuels, said Carmack. Applying those processes to fuels research will help researchers move toward cheaper, more advanced computerized methods of fuels testing.

"In the future, the idea in advanced nuclear fuel development is to be less dependent on lengthy and costly experimental testing and move towards computerized modeling and simulation," said Carmack. "To do this, a basic understanding of the fundamental material behavior of irradiated nuclear fuel is needed, similar to the basic understanding the computer industry has of microchip materials."

Plans include integrating some of the new analysis instruments into a shielded suite--a hot-cell environment where the instruments are installed side-by-side, allowing researchers to quickly pass samples between instruments. The suite will be integrated into INL's operation of the Hot Fuel Examination Facility (HFEF), unique from other hot cells around the world because of its inert gas environment and cleanliness, creating a one-of-a-kind research environment for nuclear fuels examination.

Photo: Hot cell

A hot-cell environment.

HFEF began operation in 1974 for the purpose of examining nuclear fuels and materials from the world-renowned EBR-II fast spectrum test reactor. HFEF capabilities have been in need of upgrade for many years, including enhancement to its Neutron Radiography (NRAD) capability. NRAD is a one-of-a-kind non destructive characterization technique that has served the world nuclear research community for many years. Upgrades will help preserve this capability for GNEP and other post-irradiation examination programs.

Current plans call for equipment to be purchased by September 2007 and installations to be complete by the end of 2008. Among instruments to be purchased, replaced or upgraded are a shielded electron microprobe, thermal ionization mass spectrometer, dual-beam focused ion beam microscope, micro-scale x-ray diffractometer, scanning thermal diffusivity microscope, metallography station upgrade, precision gamma scan upgrade, and gas sampling and analysis system upgrade.

"The DOE commitment to provide this money for upgrades in material characterization techniques for post-irradiation examination shows its commitment to support the development of nuclear power for the future," said Carmack.

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